

U.S. Department of Agriculture
Forest Service - Region 2

SECTION 02201
TRENCHING, DRAINFILL, AND BACKFILL

PART I - GENERAL

- 1.01 This item shall consist of excavating and backfilling trenches in accordance with these specifications and details shown on the drawings, to the lines and grades established. This specification covers clearing and grubbing, stockpiling topsoil, excavation, safety, shoring and protection, removal of water, bedding, backfill, compaction of material, marking tape, waste material disposal, trench resurfacing, finishing and area cleanup. All utility installation in the trenches will be covered under separate sections.
- 1.02 Method of Measurement - There will be no separate measurement for trenching or placing and compacting backfill; rather, trenching shall be considered to be included in the measurement of the drain lines contained within the trench. Measurement for drainfill and imported backfill shall be measured as follows:

Drainfill - Imported - The quantity measured shall be the number of cubic yards of drainfill processed, and hauled to the site measured in the truck. The price shall include placing the material in the trench to the designed depth, as required. Any material lost between truck measurement and final placement in the trench due to stockpiling, etc., shall be deducted from the measurement. Drainfill material from trench excavation will not be considered a part of this item.

Imported Backfill - Pipe Zone - The quantity measured shall be the volume of selected backfill material excavated, processed, and hauled to the site.

The imported backfill pipe zone material shall be measured in the trench. The number of cubic yards shall be calculated using the trench configuration indicated on the drawings. If the trench is excavated deeper, as noted in Paragraph 3.03B, the measured depth will be computed to include the increased depth to a point 12 inches above the top of the pipe.

Imported Backfill - Above-Pipe-Zone - The quantity shall be measured in the trench of selected backfill material excavated, processed, and hauled to the site. The number of cubic yards shall be calculated, using the trench configuration indicated on the drawings.

- 1.03 **PAYMENT** – The accepted quantity, measured as provided above, will be paid at the contract price per unit of measurement for the pay item listed below that is designated in the SCHEDULE OF ITEMS.

A. Payment will be made under:

Pay Item

Pay Unit

02201 (01) Trenching & Backfilling.....Design Quantities (DQ)

02201 (01) Coarse Drainfill.....	Design Quantities (DQ)
02201 (01) Fine Drainfill.....	Design Quantities (DQ)
02201 (01) 4" Diameter Slotted HDPE Pipe..... with all necessary connectors	Design Quantities (DQ)
02201 (01) 4" Diameter Solid PVC Pipe..... with animal guard	Design Quantities (DQ)

PART II - PRODUCTS

- 2.01 Marking Tape - Three-inch wide marking tape shall be required as indicated below when shown on the trench cross-sectional drawings. If not shown, it is not required.
- A. Over Metallic Utility - Marking tape in trenches over metallic utilities shall be a 4 mil thickness of inert plastic film. The tape shall be brightly colored to contrast with soil and shall bear an imprint identifying the type of line buried below. Marking tape shall be "Standard Terra Tape" as manufactured by the Griffolyn Company of Houston, Texas, or "Identoline" as manufactured by the W.H. Brady Company of Milwaukee, Wisconsin, or an approved equal.
 - B. Over Non-Metallic Utility - Marking tape in trenches over non-metallic utilities shall be an inert plastic film as described above bonded to a 1-1/2 mil metallic backing. Marking tape shall be "Detectatape" as manufactured by Allen Systems, Inc., of Wheaton, Illinois, or "Terra Tape - Detectible" as manufactured by the Griffolyn Company of Houston, Texas, or an approved equal.
- 2.02 Unsatisfactory Material, Bedding and Backfill Material, and Surfacing Materials - See Paragraphs 3.03B; 3.06, A1, B1 and C; and 3.08 of this section.
- 2.03 Seepage drain shall be 4 inch diameter AS SHOWN ON THE DRAWINGS. Drain shall be Polyvinyl Chloride (PVC) schedule 40 pipe for 20 linear feet at outlet and equipped with an animal guard AS SHOWN ON THE DRAWINGS. HDPE Perforated drain is AS NOTED ON THE DRAWINGS, with slotted perforations and with a two zone drainfill consisting of a fine drain material in the outer zone and a coarse drain fill for the inner zone AS NOTED ON THE DRAWINGS. The HDPE perforated pipe shall be as manufactured by Advanced Drainage Systems, INC., Columbus, OH or an approved equal. Connections between sections of HDPE pipe shall be with snap connectors as manufactured by Advanced Drainage Systems or approved equal. Upstream end of HDPE pipe shall be capped with end cap and connection between PVC and HDPE pipe shall be made with connector as manufactured by Advanced Drainage Systems or approved equal.
- A. **Polyvinyl Chloride (PVC) Pipe and Fittings** - All PVC pipe must meet requirements as set forth in ASTM Specification D-3033 or D-3034. All material must meet ASTM Specification D-1784. Provisions must be made for contraction and expansion at each joint with an elastomeric gasket.

- B. **High Density Polyethylene Plastic Pipe** - Polyethylene (PE) plastic pipe shall be PE 3408 as defined in ASTM D-1248 with a minimum cell classification of 345434C in accordance with ASTM D-3350.
- C. **Galvanized Steel pipe** - Steel pipe shall be SCH-40 with a wall thickness of 0.28 as defined in ASTM A-120. Pipe shall be 6 inch nominal diameter pipe with a galvanized coating. This pipe is for the cleanout for the drain line.

PART III -EXECUTION

- 3.01 **Clearing and Grubbing** - Before starting any excavation or trenching operation, the Contractor shall have completed all necessary clearing and grubbing within the specified working limits in accordance with Section 02230, "Site Clearing."

- 3.02 **Conserving Topsoil** - When shown on the drawings that it is necessary to conserve topsoil, the following will apply:

Topsoil shall be removed from the area to be excavated and from the area where trench excavated material will be piled, prior to excavating the trench. Topsoil shall be kept separate from trench-excavated material by either stockpiling or by windrowing on the opposite side of the trench from which the trench excavated material will be placed. Topsoil will be reused after backfilling on those areas from which it came.

When topsoil is shown on the drawings to be kept separate and place over the backfilled trench, it shall not be measured or paid for separately.

- 3.03 **Trench Excavation** - All trench excavation shall conform, as near as possible, to the lines and grades illustrated on the drawings.
 - A. **Classification of Excavation Material** - Excavation will be unclassified as to materials and shall include all materials which are encountered in the required excavation. Any information that has been obtained by the USDA Forest Service concerning possible ground conditions is available (at the Supervisor's Office for the Forest where the project is located) to interested parties upon request.
 - B. **Unsatisfactory Material** - During excavation, if material which does not meet the backfill requirements of Paragraph 3.06A (such as structurally unstable material, solid rock, oversized rock, angular or sharp rock), as determined by the Contracting Officer, is encountered at the grade line for the pipe or cable, which will not permit proper bedding of the pipe, the unsatisfactory material shall be removed to a minimum depth of 6 inches below the utility line. Trenching shall be performed by any acceptable method, excluding the use of explosives, as permitted by the Contract General Provisions
 - C. **Trenching by Machine or by Hand** - The use of trench digging machines will be permitted, except in places where machines may cause damage to existing structures, or drain lines in which case, hand methods shall be employed.
 - D. **Depth** - Trench excavation shall be such as to provide a uniform or gently changing flow line. Reverse grades and zero slope will be deemed unacceptable (except at outlet of pipes).

- E. Width of Trenches - The bottom width that will be used in arriving at pay quantities that are paid on the basis of volume shall be the design bottom width, AS SHOWN ON THE DRAWINGS. The width of trench allowed when computing excavation and/or backfill quantities shall be vertical lines for trenches less than 4 feet and for trenches greater than 4 feet shall be computed on 2 to 1 side slopes. In unusual circumstances where trench sides will not stand, water is encountered, or are not considered safe when sloped at 2 to 1, a slope will be determined in the field by the Contracting Officer for which pay quantities will be computed and the slopes shall be laid back to the stable slope determined.

The Contractor may excavate the trench wider than the design width shown on the drawings; however, the design width of the trench will be used to calculate the number of cubic yards of all excavated volume and volume of imported material that is paid for by unit volume.

Any over excavation (width) performed by the Contractor for his convenience shall be at his own expense.

- F. Alignment and Grade - The location of all pipelines and structures will be staked out and grades established by the Contracting Officer before excavation is started. All trenches shall conform with the lines and grades illustrated on the drawings or staked on the ground. The Contractor shall set batter boards and shall establish grade lines and levels necessary for the work from dimensions and elevations shown on the drawings and as established in the field. Any shifting or change from the indicated alignment and grade must receive prior approval by the Contracting Officer in writing.

- 3.04 Safety, Shoring, and Protection - The Contractor shall meet the General Safety Orders of the State encompassing this project and the provisions of the Occupational Safety and Health Administration (OSHA): 29 CFR Part 1926.650-.652 Subpart P. Walls of trenches, 4 feet or more in depth, shall be supported by bracing, shoring, or other methods, unless the sides of the trench are sloped to a safe angle, from the bottom of the trench or from the top edge of a steel cage when same is used. If trenches are shored, the trench shall be of proper width to accommodate shoring and bracing, as required, to keep trench walls from caving, and to allow for proper installation of the work. All existing improvements, either on public or private property, will be fully protected from damage.

All supports shall be removed after construction is completed and shall be withdrawn in a manner that will prevent the caving of the sides of the excavation and causing cross contamination within the trench. All openings in the ground, caused by the removal of supports, shall be filled with suitable material properly compacted.

- 3.05 Removal of Water - The Contractor shall provide and maintain, at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water entering the excavations or other parts of the work without damage to adjacent property. All excavations shall be kept free from standing water. Any damage caused by water in the trench shall be repaired by the Contractor at his expense.

- 3.06 Backfill Operations - Backfilling will be permitted only after all inspections of piping have been performed and tests completed or certification of materials from suppliers, when required, and the work to be covered has been approved by the Contracting Officer. Backfill, which has been

improperly placed and/or compacted, shall be corrected, if directed by the Contracting Officer, by reopening the trench to the depth required to obtain proper compaction. Then the trench shall be refilled and compacted according to specifications.

A. Backfill at Pipe Zone

1. Pipe Zone Material – Backfill material for the perforated pipe shall be the drainfill material placed AS SHOWN ON THE DRAWINGS, the solid pvc pipe backfill material shall consist of soil, sand, or fine granular material free of 6 inch or larger stones, and free of organic material for trench backfill, and stones no larger than 1 inch against pipe during backfilling.

Frozen material will not be allowed.

Backfill material shall be trench-excavated material whenever it meets specification requirements. Whenever material meeting the requirements for pipe zone backfill is not readily available from trench excavation, the Contractor will be required to import pipe zone material from a designated or approved source. Imported pipe zone material shall be paid for as such.

2. Procedure - Any backfill in trench bottom where over excavation was performed by the Contractor for his convenience, shall be brought back to the pipe grade indicated at his own expense. If the trench bottom is prepared in the wet, drainfill conforming to Paragraph 3.06C shall be used if determined necessary by the Contracting Officer.

The bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe along its entire length, except for portions of the pipe sections where it is necessary to excavate for pipe joints. Depressions for joints shall be made in accordance with the recommendations of the manufacturers for the particular joint used. The bedding shall be a minimum of 6 inches in depth under the pipe and be of either drainfill or pipe zone material as conditions dictate. Trench bottom preparation shall be such that when final placement of pipe has been made, pipe will be true to line and grade. All adjustment to line and grade shall be made by scraping away or filling in with pipe zone material or drainfill material, as conditions dictate, under the body of the pipe and not by wedging or blocking.

All compaction within the pipe trench, shall meet the following: Drainfill shall not be mechanically compacted, backfill around and over PVC pipe shall be mechanically compacted in lifts of loose fill material not greater than 9 inches in depth.

B. Backfill Above-Pipe-Zone

1. Above-Pipe-Zone Material - Backfill material shall be free from brush, perishable material, trash, rocks, or boulders larger than 6 inches in greatest dimension, or frozen material.

Backfill material shall be trench-excavated material whenever it meets specification requirements. Whenever trench excavated material contains less than 10 percent of oversized material, the Contractor will be required to remove boulders larger than 6

inches from the trench excavated material at no additional compensation and utilize it as backfill material. If, after all suitable trench excavated material has been used as backfill, the trench is not filled to the required grade, the Contractor shall delay his backfill operations until the Contracting Officer can obtain profile elevations of the top of the partially filled trench. These elevations shall be used in computing the cubic yards for which payment will be made for imported material. Whenever material meeting the specification requirements for backfill above the pipe zone is not available from trench excavation, the Contractor will be required to import material from a designated or approved source. Imported above-pipe-zone material shall be paid for as such.

2. NOT USED

- C. Drainfill Material - Imported - Drainfill material shall consist of rounded river gravel or crushed, free-draining material, meeting the following gradation, as determined by AASHTO Specifications. The fine drainfill shall meet AASHTO Specification M 6-81. The coarse drainfill shall meet AASHTO Specification M 43-82

DRAINFILL GRADATION

SIEVE SIZE	FINE DRAINFILL Percent Passing*	COARSE DRAINFILL Percent Passing*
6"		
4"		
2"		
1"		100
3/4"		90-100
3/8"	100	30-65
#4	95-100	5-25
#8	80-100	0-10
#16	45-80	0-5
#30	25-60	
#50	10-30	
#100	2-10	
#200	0-5	

*Percent passing by dry weight.

Any substitution of drainfill material must be approved in writing by the COR prior to bringing material to the work site. The material shall require a sieve analysis prior to approval.

Drainfill shall be placed, as directed by the Contracting Officer, in trenches, as necessary, to provide a minimum of 6 inches firm bedding on which to set the pipe in areas where

relatively unstable conditions exist, due to seeping ground water or mud caused by ground water, or by water from any other source which cannot be diverted. After the material is placed in the trench, leveled, and consolidated, it shall be trimmed to proper sub grade and shaped to receive the pipe.

- D. Imported Material - Any trench excavated material that can be transported less than 300 feet to other areas along the trench and used, in accordance with specifications, shall not be considered as imported material. When the Contractor is required to import material, it shall be from a designated or approved source.
 - E. Trenches in Embankments - When pipelines are to be placed in trenches excavated in embankments, the excavation of each trench shall be performed after the embankment has been constructed to a point at least 3 feet over the pipe or to finish grade, whichever is least.
 - F. Surface Restoration in Areas Other Than Roads - All surfaces shall be restored to the required grade (usually original ground line), mounded over or smoothed off as directed, and left in a uniform and neat condition, to the satisfaction of the Contracting Officer. Surface drainage shall be diverted so that it will not follow along a trench. In areas where natural revegetation is designated (no planting to be done), the Contractor shall scarify all disturbed or compacted areas and right-of-ways such that the surface of the ground is loose to a depth of at least one inch. In areas to be seeded, the area shall be prepared in accordance with the seeding specification.
- 3.07 Waste Material Disposal - Any excess excavated material that can be transported less than 300 feet within the total project area and used in accordance with other project specifications will not be paid for separately. For disposal of excavated material in excess of total project needs or material not meeting backfill or other specifications, the Contractor shall see Section 02230, "Site Clearing," as applicable.
- 3.08 Finishing and Cleanup - After the pipeline installation and backfill has been completed, the disturbed area along the pipeline shall be finish graded to present as near a natural appearance as possible and cleaned up by removing all debris and materials not utilized. Stockpiled topsoil shall be smoothly distributed over disturbed areas and prepared for seeding when required on the drawings.

END OF SECTION